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over the two-wire plan, is, that if needed for purposes of driving motors, or for large street-lamps of higher resistance, a potential twice as high as the ordinary one is very simply available by connecting across from I to III, or three times as high from I to IV in the four-wire plan, etc.; and, no matter what the amount of such employment, it will not disturb the balance of the intermediate lower potential circuits.

H. M. PAUL.

ZOOLOGICAL RESEARCHES OF THE SCOTTISH FISHERY BOARD.

THE Scottish fishery board has for its principal function the administration of public matters relating to the fisheries of Scotland; but since its reconstitution in 1881 it has been endeavoring to perform some of the functions so successfully exercised by the U.S. commission of fish and fisheries. It has recently published its report for the year 1883, the second annual report since its reconstitution. In the general report, a short introduction is followed by a chapter on the herring. The first part of this consists of a summary of inquiries into the natural history of the herring, carried out before the year 1882; to this succeeds a summary of the history and results of similar work done in foreign countries; and, finally, there is an account of the researches undertaken by the board since its reconstitution. The rest of the report is taken up with statistics of the various fisheries, and a few paragraphs on the salmon-fishing.

The remaining and of course much the larger portion of the volume is devoted to the various appendices, in which fuller details are given on matters discussed in the general report. Of these, Appendix F describes the investigations carried out at the instance of the board, while Appendix G is Mr. Young's report on the salmon-fisheries.

The biology of the herring, of course, occupies a prominent place in the volume; and in its discussion there is a tendency to optimistic assumptions, which are not in accord with the true spirit of research. For example: the board, or its scientific committee, proposes in the present autumn to deposit, on some of the inshore banks in the Moray Firth, some millions of fertilized herring-eggs; and then, if next year the said bank is visited by a shoal of comparatively small herring, it will conclude, 1°, that they are the produce of the eggs deposited this year; 2°, that herring, like salmon, when about to spawn, instinctively seek their birthplace; 3°, that the migration of herring is limited, and that, in course of time, special varieties of herring may have been formed at different parts of the coast; and 4°, what is of even more importance, that when any particular spawning-ground is deserted, the fishing may be restored without waiting till accident brings another shoal. Investigation would be a very simple matter, if every experiment were as fruitful in inferences as this. The board will have to prove, in the first place, that the herrings, if it finds them next year, are the produce of the eggs it has laid down. He is a wise

herring-breeder that knows his own herrings in the open sea.

Professor Ewart's essay on the natural history of the herring forms No. iv. of this appendix. It is, for the most part, an abstract of a paper read by him before the Royal society of London, on the spawning of the herring, and the examination of a spawning-bed at Ballantrae, on the west coast of Scotland. Professor Ewart observed for the first time the spawning and fertilization of herring-eggs in an aquarium. The process, as he describes it, is probably the same, or nearly, as that which takes place in the sea. But it would have been more satisfactory, if, when he had the opportunity, he had observed the behavior of a number of male and female herrings in the same tank. In his experiment there was but a single female herring. The discussion of other problems connected with the life-history of the herring is not very luminous. The author concludes that herring have come to spawn in spring and autumn because the food of the young fry is more abundant at those seasons than at others; but he has no evidence to show that minute pelagic animals are less abundant at a given place in summer than in spring and autumn. A quantitative investigation of the pelagic life at a given spot throughout the year has not yet been carried out, and such a research would be very valuable.

The report on the sprat-fishing, by Mr. Duncan Matthews, contains a record of much good and interesting work, and raises a question of general interest in marine biology. A certain proportion of young herring are killed with the sprats in the firths of Scotland, and herring-fishers believe that this injures their industry. This contention does not seem very important, after such a season as the last, when herrings were so plentiful off the east coast of Scotland that it was almost impossible to find a market for them. But it is of interest to note the difficulty of deciding whether the abundance of a species depends more on the variations in its food-supply than on the attacks of its enemies, or *vice versa*. It is possible, in the case of the herring, that the destruction caused by all its enemies, including man, is insignificant in comparison to its breeding-powers, and that the number which reaches maturity depends entirely on the amount of food available.

PSEUDO-SCIENCE.

The true theory of the sun. By THOMAS BASSNETT. New York, Putnam's, 1884. 41+263 p., illustr., 1 pl. 8°.

WE nowhere find in this volume a systematic attempt to arrive at legitimate deductions from all the collected work of observational astronomy and meteorology; but page after page is devoted to the author's baseless speculations, and to the details of such of his own isolated observations as serve to confirm these speculations, while the labors of others, not condu-

cing to the safety of his hypotheses, are cast aside; as, for example, the well-known work of Carrington on the solar spots, "for the sun was an especial study with him [the author] before Mr. Carrington was born, and he prefers his own approximations" (p. 30).

It is not, however, so hard to see how an ill-balanced enthusiast may persist in this course indefinitely, as it is difficult to conceive of the intellectual stupefaction which busies itself with the preposterous invention of suitable facts to match agreeable hypotheses. When, for example, Mr. Bassnett finds his theory of ethereal vortices cannot help going to pieces when he tries to make it account for the observed phenomena of the periodicity of the solar spots, he has no hesitation in fabricating a great planet outside of Neptune, of such mass, and position, and distance from the sun, as to bring about the absolute harmony of his hypothesis with the observed periodicity; nor does he shrink, when he finds it necessary, to make this convenient planet travel round the sun in just the other way from what all the hitherto recognized planets do.

But unaccountable idiocy can be tolerated where unconscionable conceit cannot. When the world's greatest investigators of solar phenomena confess that the sun and its surroundings are the mystery of cosmical physics, this writer pops into prominent print with a book "whose credentials are an undeniable ability to divest that subject of its mystery." Sun-spots, to say the least, have yielded all their secrets to him; and he retires from an excursion of half a hundred pages on his own theory of the solar spots with a self-complacency more alarming than a thousand eureka's, for he finds that "the solar spots are not such formidable mysteries, after all" (p. 172).

The gross failure of the author's life as a scientific man appears to lie, just where many lives make shipwreck, in his early penetration with the idea that his destiny was with the great. It was for others to drudge in collecting facts, but for him to cut a grand figure in the development of striking and original generalizations,—an unhappy fallacy of ill-balanced minds. "Our business," he says, "is to establish a *theory*," etc.; and later (p. 129) we are told that "in 1853 the author published the only possible solution of the problem [of sun-spot periodicity]." The persistent refusal of scientific men to recognize his arrogant claims leads him to indulge a vindictive insolence. His experience of the treatment which his theory of electric vortices has received during the past thirty years is a sorry one, and

encourages occasional despondency, and the "growing conviction that the scientific world, as a body, loves darkness rather than light." However, he falters not; for it is better to "have the approval of a few kindred spirits, than drift with the current which is sweeping a deluded majority to inevitable oblivion."

How long ought the patience of scientific men to indulge this badgering assumption? Mr. Bassnett has repeatedly addressed himself to the acknowledged leaders in science, and has been just as repeatedly snubbed. At various scientific assemblies he and his ubiquitous electric vortices have been the dread of presiding officers, and the butt of 'Section A.' So far, however, from inculcating the necessity of humility, all these merited rebuffs have only emboldened him to renewed impertinence, which he has the effrontery to term 'scientific spirit.'

A book so nearly valueless we have rarely seen. A single chapter, however,—that on the ethereal medium,—is worth the reading: it is suggestive as to lines of research which may some time come to be worth following out; and the vigorous statements of the author's beliefs are an interesting study. But as a whole, little good, if any, can come from the printing of such a volume; and with equal certainty the harm it can do is a minimum, for its readers will be few, and chiefly confined to such of the curious as know too much to be led astray.

THE VALUE OF SORGHUM.

Sorghum: its culture and manufacture economically considered as a source of sugar, syrup, and fodder.
By PETER COLLIER, Ph.D., late chemist of the U. S. department of agriculture. Cincinnati, Clarke, 1884. 11+570 p., illustr. 8°.

ALTHOUGH the cultivation of sorghum in the United States, and its utilization as a source of sirup, date from about the middle of this century, and although more or less frequent attempts to produce sugar from it had been made at the time when the U. S. department of agriculture began its investigations (1878), the most conflicting opinions prevailed as to the value of the plant as a source of sugar. The remarkable growth of the sorghum-sugar industry within the last few years, and the very general interest in the subject now manifested, may be fairly ascribed mainly to those investigations, and to others which were incited by them.

It is a matter of congratulation, that the task of recording the results of recent inves-